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Claims 1 and 3 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over El-Kareh et al. (U.S. Patent No. 4,725,562) (hereinafter "El-Kareh") in view of MacDonald et al. (U.S. Patent No. 5,770,465) (hereinafter "MacDonald"). This rejection is respectfully traversed.

Applicant submits that independent claim 1 is patentable because (1) El-Kareh and MacDonald taken singularly or in combination, fail to disclose patentable features recited in the claim, and (2) the combined disclosures of El-Kareh and MacDonald do not render the pending claim obvious because there is no motivation, absent the hindsight reconstruction of the present invention, to modify the disclosure of El-Kareh in accordance with the disclosure of MacDonald.

1. Failure to Teach Features Recited in the Claim

It is asserted in the Office Action that El-Kareh discloses the invention of independent claim 1 with the exception of Applicant's claimed trench depth of 50-150 μm . While the Patent Office alleges that MacDonald makes up for the deficiencies of El-Kareh, Applicant submits that MacDonald fails to teach or suggest this limitation.

As equipment becomes larger in size and capacity, high voltage semiconductor devices having a high breakdown voltage, a high current and a fast switching speed become more important. In order to decrease power loss in a conductive state even while a large amount of current is flowing, the saturation voltage of high voltage semiconductor devices is required to be low. High voltage semiconductor devices are fundamentally required to have a characteristic of resisting a reverse high voltage applied to both ends thereof in an off-state or at the moment the device is turned off. That is, high voltage semiconductor devices are fundamentally required to have a high breakdown voltage. A variety of breakdown voltages of power semiconductor devices are required to be in a range from several tens of volts to several thousands of volts.

Generally, the breakdown voltage of a semiconductor device largely depends on a depletion region extending from a PN junction, and particularly, is greatly influenced by the curvature of the depletion region. In particular, for a planar junction, an electric field is concentrated on the edges, which have a large curvature, thereby decreasing the overall breakdown voltage. Accordingly, a number of methods have been proposed in order to obtain

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high breakdown voltage by preventing an electric field from being concentrated on the edge of a junction.

The present invention accomplishes the above by utilizing a high voltage semiconductor device having a trench with a width that is 1/10 times the depth of the trench. The shape of the depletion area varies depending on the width of the trench, and the breakdown voltage property varies depending on the shape of the depletion area. In the invention, as set forth in claim 1, the trench is applied to a high voltage power discrete device, and is positioned at a "junction termination." The trench only penetrates the p base region, and has a depth of "50-150 μm ."

Contrary, the trench of El-Kareh is applied to a general IC structure, and is positioned in an active cell. Further, the trench penetrates the p base region and n+ emitter region, and the depth of the trench is several μm .

MacDonald fails to remedy the deficiencies of El-Kareh. In fact, MacDonald is non-analogous prior art and relates to a trench-filling etch-masking microfabrication technique. The trench of MacDonald is not analogous to the trench of claim 1. To be sure, "[t]he first step ... is to etch deep trenches in a silicon wafer ... with the depth of the trenches equal to the desired height of the oxide mask (e.g., 100 microns). The trench is 100 microns and NOT in the range of 50-150 μm .

2. Flawed Motivation to Combine

"When a rejection depends on a combination of prior art references, there must be some teaching, suggestion, or motivation to combine the references." In re Rouffet, 47 USPQ2d 1453, 1456 (Fed. Cir. 1998); see also MPEP § 2143.01. Virtually all inventions are combinations of old elements. See In re Rouffet, 47 USPQ2d at 1457. If identification of each claimed element in the prior art were sufficient to negate patentability, the Patent Office could use the claimed invention itself as a blueprint for piecing together elements in the prior art to defeat the patentability of the claimed invention. See id. To prevent the use of hindsight based on the teachings of the patent application, the Patent Office must show a motivation to combine the references in the manner suggested. See id. at 1457-58.

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In Rouffet, the Court of Appeals held that although all elements recited in the claims of Rouffet's application were disclosed in the applied prior art references, the rejection under 35 U.S.C. § 103 was improper because there was no suggestion as to why one skilled in the art would have been motivated to combine the references in such a manner as to render the claims obvious. See id. at 1457.

The situation is, at best, the same in this case. Even if all elements recited in the pending claims can be found in the combined disclosures of El-Kareh and MacDonald, although they are not, there is no reason that one of ordinary skill in the art would have been motivated to combine these references in such a manner as to render the pending claims obvious. It is suggested in the Office Action that "[i]t would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the teaching of MacDonald to the trench of El-Kareh's device since a device with such a deep trench conforms the current trend in microstructure designs" [sic]. That stated motivation, however, is not suggested anywhere in the applied references; it is no more than a hindsight reliance on the teachings in the present application of the advantages of the present invention. The current trend in microstructure designs is NOT a trench depth of 50-150 μm , as recited in claim 1.

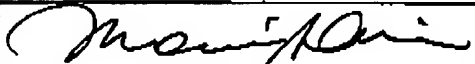
Based on the foregoing remarks, independent claim 1 cannot be rendered obvious over either the individual or the combination of the El-Kareh and MacDonald references, and the rejection of this claim should be withdrawn.

Further dependent claim 3 depends from independent claim 1 and should be allowed for at least the same reasons discussed above with respect to claim 1. Applicant respectfully requests withdrawal of the rejection of this claim.

In view of the above remarks, withdrawal of the rejection under 35 U.S.C. § 103(a) is respectfully requested.

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It is respectfully submitted that the present application is now in condition for allowance.
Reconsideration and favorable action are earnestly requested.

| RESPECTFULLY SUBMITTED, | | | | | |
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